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ABSTRACT

This report summarizes federal research and development (R&D) funding estimates for 1976 and the requested funding for 1977. R&D obligations are expected to rise to $21.6 billion in 1976, 5.7% of the total budget; $23.5 billion is requested for 1977, 6.0% of the total budget. Tabulated data presents funding obligations by agency, character of work, major performer, field of science, and geographic distribution. Program changes by major agencies for 1977 are also included. (SL)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION • WASHINGTON, D. C. 20550 • AUGUST 10, 1976 • NSF 76-317

Federal R&D Funding Shows Moderate Increase for FY 1977

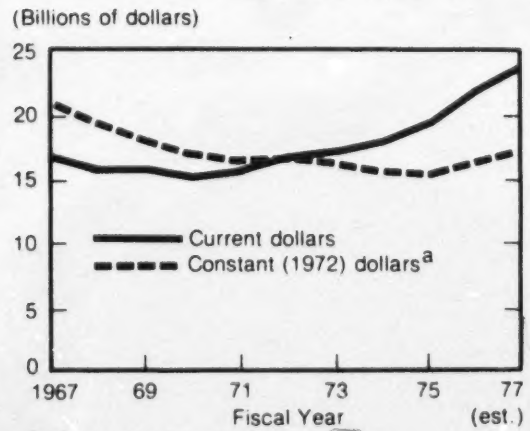
The following data are taken from Federal Funds for Research, Development, and Other Scientific Activities, Volume XXV, *to be published later this year. Data reflect estimates for 1976 and requested amounts for 1977, as shown in the President's budget message to Congress. The survey on which the report is based was conducted at the midpoint of fiscal year 1976, shortly after the budget message for 1977. Final legislative and executive decisions will change, by varying degrees, the amounts shown in the report.*

Federal R&D obligations (plant excluded) amounted to $19.0 billion in fiscal year 1975 and are expected to rise to $21.6 billion in fiscal year 1976 and $23.5 billion in fiscal year 1977. The increases for the last two years are 13.5 percent and 8.6 percent, respectively.

Although the growth in each of these years is ahead of anticipated inflation, the long-term trend of the R&D portion of the budget has been downward. When R&D funding levels are translated into constant dollars, a steady decline from the 1967 high point is shown through 1971. A slight rise in 1972 is followed by another decline to a 1975 low that represents the least Federal R&D support for the entire 10-year period. The estimated increase for 1977 will restore real performance to a level close to that of 1972, although still approximately 20 percent below that of 1967.

In recent years the share represented by R&D and R&D plant expenditures within the total budget has been steadily reduced—from 10.7 percent in 1967 to an estimated 5.7 percent in 1976. The estimated increase in 1977 to 6.0 percent reflects the added emphasis in the current budget on R&D programs as a whole.

Trends in Federal R&D obligations



[a] Based on GNP implicit price deflator

SOURCE: National Science Foundation

Another way of measuring the R&D component of the budget is against relatively controllable budget outlays, and with this relationship a somewhat different pattern emerges. The controllable area of the budget, of which R&D programs are a part, is subject only to annual appropriation action as distinct from the uncontrollable area where the growth of fixed cost and open-ended programs[1] cannot be controlled without changes in existing substantive law. In 1967 R&D and R&D plant outlays made up 16.3 percent of relatively controllable outlays, and since then the ratio has fluctuated under this figure, both falling and rising. In 1976 an estimated share of 13.5 percent (the low point) will be followed by an estimated 14.9 percent share in 1977.

Character of Work

In 1977 the estimated shares of the character of work components within the Federal R&D total are 11 percent for basic research, 23 percent for applied research, and 66 percent for development.[2] These proportions have changed in the past 10 years in the direction of increasing emphasis on research in comparison with development; in 1967 the total research share was 28 percent and the development share, 72 percent.

The basic research total of $2.5 billion for 1977 is 7.4 percent higher than the 1976 estimate, but in real terms little change is realized. Although the 1977 figure is a record high, it is 18 percent lower than in 1967 on a constant-dollar basis. The Department of Health, Educa-

[1] Social security, medical insurance, veterans benefits, public assistance, interest, and other programs. See Office of Management and Budget, *The Budget of the United States Government, Fiscal Year 1977*, table 16 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office), pp. 354-55.

[2] A reclassification of NASA programs by character of work has resulted in significant changes in overall Federal character of work relationships. Most of the major NASA projects are now categorized entirely as development since they primarily generate outer space transport technology. In former years substantial portions of these projects were classified as basic or applied research. Since NASA programs are sizable, these shifts have resulted in lower basic research and applied research shares of the Federal R&D total for prior years as well as the current period and a larger share for development.

Prepared in the Government Studies Group, Division of Science Resources

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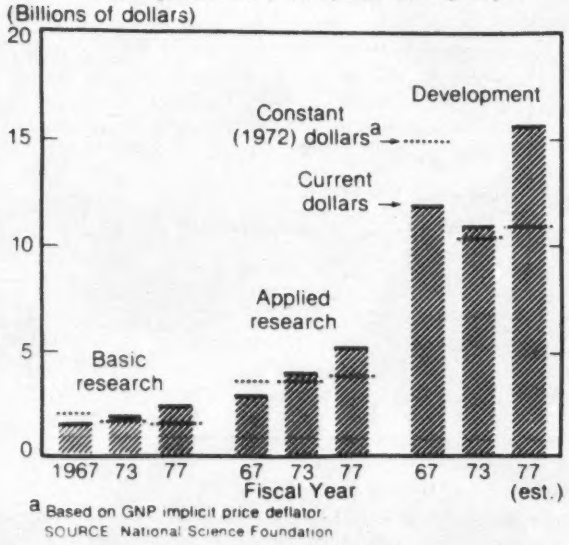
Federal R&D obligations by character of work: fiscal years 1967, 1973, and 1977 (est.)



[a] Based on GNP implicit price deflator.
SOURCE: National Science Foundation

tion, and Welfare (HEW) and the National Science Foundation (NSF) together account for slightly more than one-half of basic research support in 1977, about equally divided.

The anticipated applied research figure of $5.3 billion is 2.1 percent higher than the 1976 figure, or approximately 4 percent lower when inflation is taken into account. Even after conversion to constant dollars, however, the applied research level for 1977 is no lower than 10 years earlier; in fact, it is slightly higher. Chief agency sponsors of applied research in 1977 are the Department of Defense (DOD), with one-third of the total, and HEW, with one-fourth.

Development is the only R&D component that will reflect a real rise in actual activity in 1977. The estimated total of $15.6 billion is not only a record high but also an increase of 5 percent over 1976 in estimated real dollars. But a comparison with 1967 on a constant-dollar basis reveals a drop for the decade of 26 percent in actual development performance. More than nine-tenths of the 1977 development effort is accounted for by DOD, the National Aeronautics and Space Administration (NASA) and the Energy Research and Development Administration (ERDA), with DOD accounting for three-fifths.

1977 Program Changes

DOD and ERDA are the chief factors in the 1977 rise in overall Federal R&D funding. The increases or decreases of other agencies play a relatively small part in the extent of the anticipated growth.

DOD In 1977 DOD is scheduled for growth of $1,320 million, which represents more than two-thirds of the increase for Federal R&D funding as a whole. This agency will account for an estimated 48 percent of the Federal R&D total in 1977.

Greatest dollar expansion is reflected by Navy programs, of which the fastest growing are the F-18 fighter aircraft, the sea-launched cruise missile, the LAMPS helicopter, the CSEDS test site, and the fleet ballistic missile system. The Trident submarine-launched missile system is still the major naval program, but funding is reduced as development enters a later stage. Army programs show the next largest dollar growth, of which the most rapidly expanding are the advanced attack helicopter, the XM-1 tank system, the adaptation of the French/German Roland short-range air defense system, the cannon-launched guided projectile (CLGP), and the Pershing II nuclear strike missile. Development continues on the ballistic missile defense system technology program and the BMD advanced technology program. The Air Force places growing emphasis in 1977 on the F-16 air combat fighter, the advanced airborne command post, advanced ICBM technology, and the air-launched cruise missile. Development of the B-1 bomber continues but at a lower level than in 1976.

NASA The $99 million increase for NASA in 1977 is only 3 percent ahead of 1976, placing this agency's efforts at 15 percent of all Federal R&D obligations.

The space shuttle, which accounts for more than one-third of the entire NASA program in 1977, is scheduled for an important increase. A number of increases are also shown for space applications programs, notably earth resources, ocean condition, and environmental quality monitoring. Increased effort is scheduled as well for aeronautical research and technology. Within the space sciences, however, a significant decrease will occur in funding for lunar and planetary exploration as the Viking and Outer Planet missions move into the launch stage.

ERDA The R&D programs of ERDA are expected to grow by $476 million in 1977, the equivalent of one-fourth of the total Federal R&D gain. These programs will make up an estimated 14 percent of all Federal R&D programs in 1977.

Federal obligations for research and development, by agency: fiscal years 1975-77

[Dollars in millions]

Agency	Actual	Estimates	
	1975	1976	1977
Total	$19,044	$21,625	$23,488
Department of Defense	9,012	9,905	11,225
National Aeronautics and Space Administration	3,064	3,448	3,547
Energy Research and Development Administration	2,072	2,804	3,280
Department of Health, Education, and Welfare	2,375	2,603	2,538
National Science Foundation	595	623	718
Department of Agriculture	420	478	503
Department of Transportation	312	372	352
Department of the Interior	281	330	313
Environmental Protection Agency	258	312	246
Department of Commerce	215	239	235
Other agencies	439	511	531

Note: Detail may not add to totals because of rounding.
Source: National Science Foundation.

Although fossil energy development, the chief growth area in 1976, is now scheduled for a decrease as coal processing pilot plants near completion, other program increases in 1977 more than offset this reduction. Fission power reactor development, almost one-fifth of the ERDA effort, will reflect the largest dollar increase. Fuel cycle R&D, another nuclear program, is expected to grow two and one-half times, and magnetic fusion will receive considerably greater emphasis. Solar energy development is another area scheduled for significant growth, as is end use conservation. Weapons R&D activities, which make up almost one-fifth of the total R&D effort of ERDA, will also expand considerably, even though plans for naval reactor development reflect a decline.

HEW In 1977 the R&D funding for the Department of Health, Education, and Welfare shows a $65 million decrease, or 2 percent. Even so, HEW will still account for an estimated 11-percent share of the Federal R&D total.

The National Institutes of Health (NIH) and certain other HEW subdivisions reflect reduced funding in 1977, which more than offsets the increases planned for the National Institute of Education (NIE) and the Office of Education (OE). The reason for the net decline is that Congress took final action on the HEW 1976 appropriation after submission of the President's 1977 budget in January. This resulted in a 1976 R&D increase of $234 million for HEW (primarily NIH) over the total estimated for 1976 in the budget message.

NSF The National Science Foundation, with an increase of $94 million indicated for 1977, is expected to make up 3 percent of all Federal R&D obligations.

The increase reflects higher research project support to all the science disciplines, especially to physics and to physiology, cellular and molecular biology. Another growing area is U.S. Antarctic research support. A decrease in the RANN (Research Applied to National Needs) program is chiefly the result of the transfer of energy research programs to ERDA.

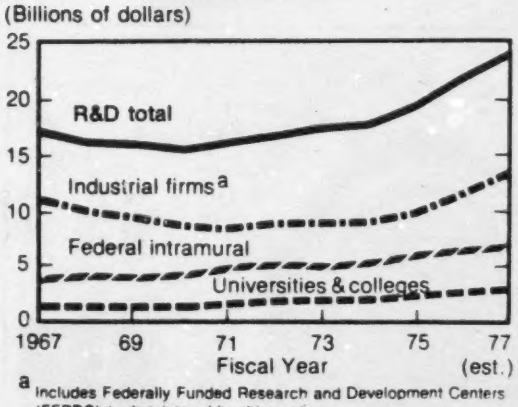
USDA The increase of $24 million for the Department of Agriculture will largely be directed to research at agricultural experiment stations, and to research on plant production. The USDA programs will make up an estimated 2 percent of all Federal R&D obligations in 1977.

Other agencies The next four agencies in size of R&D support in the 1977 budget—the Departments of Transportation (DOT) and the Interior, the Environmental Protection Agency (EPA) and the Department of Commerce—all reflect decreases from their 1976 R&D funding levels. The EPA decrease is by far the greatest, and the chief cause is expected completion of several portions of its energy-related environment assessment program. The drop for DOT stems from a decline in R&D efforts of the Federal Railroad Administration and that of Interior primarily from a decline in Bureau of Mines activity.

Performers

In 1977 an estimated $17.4 billion, or 74 percent of the Federal R&D total, is scheduled for support of extramural performance. The remaining $6.1 billion, or 26 percent, is expected to be directed to intramural performance or work by Federal personnel.

Trends in Federal R&D obligations by major performer



[a] Includes Federally Funded Research and Development Centers (FFRDC's) administered by this sector

SOURCE National Science Foundation

The share represented by industrial firms shows a tendency to rise in the current (1975-77) budget period after declining from 1967 through 1974. Industrial firms (including FFRDC's)[1] are expected to accomplish 52 percent of the total in 1977, compared with 50 percent in 1976. Universities and colleges will account for an estimated 11 percent, compared with 12 percent in 1976, and the intramural share is expected to be 1 percentage point lower than the 1976 share of 27 percent. The increased use of industry in the current period derives from expanded DOD, ERDA, and NASA programs.

Federal support to universities and colleges shows an almost unbroken rise from $1.5 billion in 1967 to an estimated $2.6 billion in 1977 (the only drop occurring in 1970). When totals are converted to constant dollars, however, growth is found to be uneven, and a 3-percent decrease is shown from 1976 to 1977. HEW will, as in recent years, continue to account for an estimated 50 percent of all Federal R&D funding to universities and colleges in 1977 and NSF for 20 percent.

Fields of Science

The life sciences are again the leading field for Federal research support, accounting for 34 percent of the total in 1977, compared with 36 percent in 1976. This area is chiefly funded by HEW—mainly NIH for health-connected research. Engineering is expected to receive the second highest amount of support, 29 percent of the total. DOD and NASA provide most of the funds for work in this area.

The physical sciences are expected to account for 15 percent with no change in share from the previous year. This field is mainly sponsored by DOD and ERDA. The environmental sciences represent 9 percent of the total research effort in 1977 and are principally supported by

[1] Federally Funded Research and Development Centers.

Federal obligations for research by field of science: fiscal years 1975-77

[Dollars in millions]

Field of science	Actual	Estimates	
	1975	1976	1977
Total	$6,929	$7,568	$7,851
Life sciences	2,450	2,709	2,698
Engineering	2,041	2,210	2,306
Physical sciences	1,025	1,104	1,194
Environmental sciences	653	693	745
Social sciences	303	364	383
Mathematics	136	143	155
Psychology	134	133	137
Other sciences	187	214	233

Note: Detail may not add to total because of rounding.
Source: National Science Foundation.

NASA and NSF. The social sciences, funded primarily by HEW, USDA, and NSF, will represent an estimated 5 percent of the Federal research total.

Geographic Distribution, 1975

The geographic protion of the *Federal Funds* survey[4] covered only the "actual" year 1975 since grant and contract awards to States cannot be fully known in advance. The survey revealed that California, the chief recipient State, had gained over 1974 in its share of the Federal R&D total while the next four States—Maryland, Massachusetts, New York, and Florida—had lost relatively to some extent.

In 1975 California received 26 percent of total Federal R&D obligations, compared with 24 percent in 1974. The total allotted to this State was $4.8 billion, a record amount.

Maryland, despite a slightly lower share in 1975, also received a record total of $1.6 billion. The same was true of Massachusetts, which had a somewhat decreased share but received a record amount of $1.2 billion in grants and contracts.

The New York figure of $1.1 billion, although higher than in 1974, was still lower than in most previous recorded years. The same situation held for Florida, which showed a $797 million total in 1975, higher than 1974 but lower than in some earlier years.

All of the 10 leading States reflected increased absolute support in 1975 over 1974. The greater relative increase for California arose chiefly from larger DOD and NASA contract awards to performers within that State.

In 1975 more than $100 million in Federal R&D support was directed to each of 25 States.

Distribution of Federal R&D obligations to the 10 States leading in such support in 1975 for fiscal years 1965, 1969, 1974, and 1975

State	1965	1969	1974	1975
Total, all States (Millions of dollars)	$14,357	$15,355	$16,991	$18,549
	Percent distribution			
California	31.7%	27.9%	24.0%	26.1%
Maryland	6.1	6.3	9.0	8.7
Massachusetts	5.1	5.0	7.0	6.6
New York	9.0	7.2	6.0	5.7
Florida	3.2	5.8	4.6	4.3
Pennsylvania	3.7	4.0	3.9	4.2
Virginia	2.0	1.9	3.8	3.9
Texas	5.1	4.5	3.8	3.8
Washington	1.5	2.5	3.8	3.7
Ohio	2.6	2.8	3.3	3.2
All other States	30.0	32.1	30.8	29.8

Source: National Science Foundation.

Federal Funds for Research, Development, and Other Scientific Activities, Volume XXV will contain data on scientific and technical information along with more detailed data on R&D funding. The report will be obtainable from the Superintendent of Documents, U.S. Government Printing Office. Detailed statistical tables will be published in advance of the final report and can be obtained from the National Science Foundation, Washington, D.C. 20550.

[4] This survey included DOD, NASA, HEW, ERDA, NSF, DOT, EPA, USDA, and the Departments of the Interior and Commerce. These agencies together represented 97 percent of the Federal R&D total in 1975.

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